

The Influence of Mood States on Anchoring Effects

Senior Research Thesis

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by

Qijia Chen

The Ohio State University

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Project Advisor, Professor Ellen M. Peters, Department of Psychology

Abstract

Anchoring effects refer to the phenomenon that arbitrary numerical information can bias subsequent estimates. These anchoring effects appear to be influenced by the presence of specific emotional states. However, among existing studies that closely examined the effects of specific emotional states on anchoring, there is a lack of agreement in terms of interpretation of these results. Previous research has demonstrated that specific emotions often carry over from past situations to color future judgments (Keltner, Ellsworth, & Edwards, 1993; Han, Lerner, & Keltner, 2007). The current study further investigated the effects of sadness and happiness on anchoring effects and their underlying mechanisms. Because previous studies proposed deliberation as the potential cause of greater anchoring effects in people induced to sad mood (Bodenhausen et al., 2000), in the present study, the level of deliberation was manipulated through the presence versus absence of a cognitive-load manipulation. Consistent with previous findings, individuals induced to sad moods demonstrated greater susceptibility to provided anchors than their counterparts, but only when the cognitive load was absent. Under cognitive load, participants in all three mood states (happy, sad and neutral) demonstrated greater anchoring effects compared to their counterparts with no cognitive load; participants under cognitive load also reported greater confidence in their estimates. The result suggests that other mechanisms such as affect as spotlight may account at least in part for the difference in anchoring effects across different mood conditions.

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Introduction

Anchoring effects refer to the assimilation, or incorporation, of irrelevant numeric information into one's judgments. For example, when asked what the probability of nuclear war in the next 10 years would be, people's specific numeric answers were influenced by earlier questions containing numeric anchors such as "Is the likelihood greater than 1% (less than 90%)?" People "anchored" on these provided values, and reported their own estimates to be closer to the provided anchors so that estimates in low-anchor conditions were significantly lower than those in high-anchor conditions. The effects have been demonstrated across domains such as the estimation of the likelihood of nuclear war (Plous, 1989), judicial verdicts (Englich & Mussweiler, 2001; Englich, Mussweiler, & Strack, 2006), real estate appraisals (Northcraft and Neale, 1987), self-efficacy (Cervone & Peake, 1986), the pricing of gambles (Johnson & Schkade, 1989; Chapman & Johnson, 1994, 1999), likelihood of diseases (Peters, Slovic, Hibbard, & Tusler, 2006), and general knowledge questions (Jacowitz & Kahneman, 1995; Strack & Mussweiler, 1997). Anchoring effects have been used to explain why judgments are excessively influenced by an incidental numeric value or impression.

Two Models of Anchoring

Two major anchoring theories exist, anchoring-and-adjustment and selective-accessibility. The two theories differ greatly in their prediction of the influence of more versus less deliberation on anchoring. According to anchoring-and-adjustment theory, people first decide whether the correct answer is greater or less than the anchor and then effortfully adjust from the initial value (Tversky & Kahneman, 1974). Insufficient adjustment occurs

when attention is limited and attenuates ability and motivation to exert cognitive effort (Epley & Gilovich, 2006). Thus, Epley and Gilovich (2006) demonstrated that participants under cognitive load, compared to those in a control condition, demonstrated greater anchoring bias. They suggested that, when people's ability to think harder is inhibited by cognitive load, their adjustment process tends to be even more insufficient because they stop adjusting soon after reaching a satisfactory value. In other words, because anchoring-and-adjustment defines adjustment as an effortful process (Gilbert, 2002), it predicts that increased mental effort (i.e., deliberation) decreases anchoring effects.

On the other hand, the selective-accessibility model (Mussweiler & Strack, 1999; Chapman & Johnson, 1999) characterizes anchoring as a confirmatory hypothesis-testing process. According to this model, when given the judgment tasks, people start contemplating and testing the given anchor, with an initial hypothesis that the given value is the correct response. This confirmatory hypothesis testing increases accessibility of hypothesis-consistent information. The increased accessibility leads to greater reliance on the newly accessed information, causing the estimates to shift towards the anchor. The more effort used to test the hypothesis, the more anchor-consistent information will be generated. For example, Chapman and Johnson (1999) asked participants to estimate the number of people in Chicago who would be a victim of a property crime in the next year. In the elaboration condition, participants were instructed to list things they do that make them vulnerable or help them avoid being a victim of property crimes, whereas the participants in the control condition elaborated on an unrelated topic. Chapman and Johnson (1999) found that the anchoring effects were stronger for the participants in the elaboration condition, presumably because

they had greater accessibility to anchor-consistent information. Therefore, the selective-accessibility model makes the opposite prediction of anchoring-and-adjustment theory, specifically that greater deliberation will increase anchoring effects.

Mood States and Anchoring

Some research has linked induced mood states and their specific appraisal tendencies, with more and less deliberation, and with the effects of provided anchors. For example, Bodenhausen et al. (2000) found that sad people displayed more anchoring bias comparing to people in neutral moods. Consistent with the selective-accessibility model, they argued that the extensive, elaborative processing style associated with sadness was responsible for this phenomenon. Estrada, Isen and Young (1997) demonstrated that physicians with induced positive moods were less susceptible to the anchoring bias compared to those in neutral moods. Consistent with anchoring-and-adjustment theory, Estrada et al. (1997) proposed that because positive affect facilitated systematic processing of important or interesting material and produced more thorough and efficient problem solving, it decreased the magnitude of anchoring effects in physicians' diagnoses.

Note that these papers highlight two divergent views on the influence of positive moods on information processing. Previous research has indicated that individuals in happy moods, compared to individuals in sad moods, tend to engage in heuristic and simplistic processing, especially in the absence of specific goals that require elaborative information processing (Bless, Schwarz, & Kemmelmeier, 1996; Bodenhausen, Kramer, & Süsser, 1994). Individuals in sad moods, compared to those in happy moods, on the other hand, tend to think more extensively and systematically, and are less susceptible to various types of judgment

biases (Bodenhausen, Kramer, & Süsser, 1994). However, other research has demonstrated that people induced to positive moods engage in more flexible and efficient information processing and problem solving. Individuals in more positive moods (vs neutral moods) are thought to engage in greater elaboration (i.e., more diverse thoughts), particularly when the tasks are interesting or important, and perform better at complex decision-making tasks (Isen, 2008; Carpenter, Peters, Västfjäll, & Isen, 2013).

To summarize, sadness is characterized by extensive, detail-oriented information processing strategies (Forgas, 1995; Schwarz, 1998; Sinclair & Marks, 1992) and positive moods lead to greater creativity and produce more thorough and efficient processing at least some of the time (Isen, 2008). Although Bodenhausen and colleagues (2000) propose individuals in sad moods are more susceptible to anchoring effects because they tend to engage in greater deliberation than those in neutral mood states, both happiness and sadness seem to be associated with increased mental effort (i.e., deliberation). If sadness and happiness do not differ in terms of their amount of effortful processing, anchoring-and-adjustment theory would predict that both mood states would lead to decreased anchoring effects, whereas selective-accessibility model would predict that both mood states would result in greater anchoring effects because of increased elaboration. Therefore, Bodenhausen et al (2000)'s findings are partially in support of the selective-accessibility model in that these researchers demonstrated that, presumably, the increased mental effort associated with sadness compared to neutral moods led to larger anchoring effects. However, these findings are inconsistent with the predictions of anchoring-and-adjustment theory. Estrada et al.'s (1997) findings can be explained by anchoring-and-adjustment theory, specifically that

increased flexibility and elaboration associated with positive mood led to greater adjustment and smaller anchoring; their results are inconsistent with predictions of the selective-accessibility model.

Appraisal-Tendency Framework

The role of emotional states in judgment and choice has received increasing attention in recent years as researchers realized that decision making rarely happens in the absence of preexisting moods and emotional reactions (Damasio, 1994). The Appraisal-Tendency Framework (ATF; Lerner & Keltner, 2000, 2001; Lerner & Tiedens, 2006) has been proposed as a basis for predicting the influence of specific emotions, as opposed to more generalized good/bad valence, on decision making. ATF posits that affective states, such as sadness, are accompanied by underlying cognitive appraisal structures that give rise to perceptual lenses or “appraisal tendencies”. It is widely recognized that incidental emotions, which are caused by factors unrelated to the decision problem at hand, often include specific appraisals that persist to influence evaluations of specific objects or situations with which the decision maker is faced (Tiedens & Linton, 2001). For example, happiness is characterized by appraisals of high level of certainty, and sadness is marked by low certainty.

Inbar and Gilovich (2011) examined the role of emotional certainty in anchoring effects using the Appraisal Tendency Framework. Specifically, they observed that people under high-certainty emotions such as anger and disgust exhibited smaller anchoring effects, compared to people who were induced to low-certainty emotions such as fear and sadness. Inbar and Gilovich (2011) interpreted the decreased anchoring effects resulting from high-certainty emotions as an indication that emotions linked with certainty and confidence

produce greater deliberation. However, this explanation is at odds with most studies on the appraisal tendency of anger, which has been shown to be associated with careless, heuristic thoughts (e.g., more stereotypic judgments, less attention to the quality of arguments, and more attention to the superficial cues of messages) (Bodenhausen, Sheppard, & Kramer, 1994; Lerner et al., 1998; Small & Lerner, 2008; Tiedens & Linton, 2001).

Tiedens and Linton (2001) argue that the certainty appraisal content of emotions often accounts for the different processing styles of various emotional states. Sadness is typically associated with less confidence than happiness. Certainty appraisals of various emotions are provided in Table 1. Therefore, we suspected that the relatively low level of confidence associated with sadness versus happiness, instead of a greater level of deliberation, might account for the larger anchoring effects observed in individuals induced to sad moods.

The Current Study

In the current study, we further investigated the effect of deliberation and certainty in anchoring effects through the presence versus absence of a cognitive-load manipulation, and measured the anchor-estimate gap (i.e., an anchor-estimate gap was calculated by taking the absolute value of the difference between participants' estimates and the anchor value; it is an indication of the magnitude of anchoring effects). Anchoring-and-adjustment theory suggests that cognitive load will inhibit effortful adjustment and result in more anchoring and, therefore, smaller anchor-estimate gaps. In contrast, the selective accessibility model suggests that cognitive load should decrease individuals' capacity to generate anchor-consistent information, resulting in less anchoring and larger anchor-estimate gaps.

We expected that individuals induced to sad moods would show larger anchor-estimate gaps compared to neutral-mood participants, consistent with the findings in Bodenhausen et al. (2000); individuals induced to positive moods would demonstrate the smallest anchor-estimate gaps, consistent with the findings of Estrada et al. (1997). We hypothesized that a lack of confidence, rather than greater deliberation, would account for sad participants' susceptibility to the effect of anchors compared to happy- or neutral-mood participants. Table 2 summarizes the relationship between deliberation, certainty and magnitude of anchoring effects in sad and happy moods. Participants induced to sad moods were expected to report lower level of confidence or certainty in their estimates, compared to those in neutral or positive moods.

Method

Participants. Participants were recruited from the Amazon Mechanical Turk website and completed the task in exchange for \$0.25.

Materials. In all conditions, participants were presented with 8 estimation tasks taken from Jacowitz and Kahneman (1995). The eight target questions were as follows: 1) the length of the Mississippi River, 2) the height of Mount Everest, 3) the amount of meat eaten per year by an average American, 4) the distance from San Francisco to New York City, 5) the height of the tallest redwood, 6) the number of United Nations members, 7) the maximum speed of a house cat, and 8) the average number of babies born per day in the United States. For each estimate, participants were asked indicate their confidence in the estimate they provided.

Procedure. Participants were presented two seemingly unrelated tasks. The first task (actually the mood induction) was presented as a writing assignment, and the second one was characterized as a series of general knowledge questions.

Mood was manipulated through an idiosyncratic memory-elicitation procedure (see Strack, Schwarz, & Gschneidinger, 1985). Participants in one of the two experimental mood conditions were instructed to describe a past situation or event in which they felt either happy or sad. They were instructed to complete the task providing as many details as possible, so that someone reading their stories might even become sad or happy just from learning about the situations they described. In the neutral condition, participants were asked to describe events in a typical day in their lives. Because few studies have attempted to manipulate mood through Amazon Mechanical Turk (MTurk), we conducted a pilot test to ensure the effectiveness of the manipulation. Results of the pilot test for mood manipulation are provided in the footnote.¹ We concluded that sad vs. happy mood states could be effectively manipulated on MTurk although the results were nonsignificant for the comparisons of happy vs neutral mood.

After completing the recall task, participants moved directly to the anchoring questions. We did not include a mood manipulation check immediately after the mood induction because we were concerned that the manipulation check would reduce the effects

¹ Participants (N=294) were randomly assigned to one of three mood-manipulation conditions. Those in the sadness condition ($M_{\text{sadness}} = 4.86$) were significantly sadder than those in the happiness condition ($M_{\text{happiness}} = 2.47, p < .0001$), and control condition ($M_{\text{control}} = 2.50, p < .0001$). Participants in the happiness condition ($M_{\text{happiness}} = 7.09$) were significantly happier than participants in the sadness condition ($M_{\text{sadness}} = 5.07, p < .0001$), but not significantly happier than participants in the control condition ($M_{\text{control}} = 6.61, p = .164$).

of our mood induction (Keltner, Locke, & Audrain, 1993). Subsequent analysis showed that participants spent approximately five minutes on the mood-manipulation task.

In the second task, participants were told to judge some general knowledge items (e.g., the height of Mount Everest). For each item, they answered a comparative question about whether the target was greater than or less than the anchor value provided (e.g., “Is Mount Everest higher or lower than 45,500 feet?”), before making their absolute judgment (e.g., “How high is Mount Everest?”).

In the cognitive-load condition, participants completed the identical mood manipulation task. However, in the second task, just before the anchor-comparison questions were presented, participants assigned to the cognitive-load condition were instructed to memorize a nine-letter string for later recall and enter the letter string after the questions. We did not assess the accuracy of their answers because the main objective of this task is to keep participants cognitively encumbered.

After completing the anchoring task, Participants were also asked to fill out a brief demographic questionnaire, and a mood scale as a manipulation check. They were then thanked and briefed.

Measures.

Measures of self-reported confidence. Participants were asked to indicate their confidence level on a 9-point scale ranging from 1, “I am not at all confident about the accuracy of my estimates” to 9, “I am extremely confident about the accuracy of my estimates”, after each anchoring question.

Mood Manipulation Check Measure. Participants rated eight emotions selected from the emotional circumplex (Russell & Barrett, 1999). The emotions participants rated included “happy”, “sad”, “angry”, “sluggish”, “quiet”, “enthusiastic”, “surprised” and “calm”.

Response Time Measure. Response time was recorded by the page timer feature of Qualtrics survey software.

Results

The anchor-estimate gap was calculated by taking the absolute value of the difference between participants' estimates and the provided anchor value. Smaller anchor-estimate gaps indicate larger anchoring effects and larger anchor-estimate gaps indicate smaller anchoring effects (see Simmons et al., 2010, for a related discussion). A logarithmic transformation was applied to the distribution of obtained anchor-estimate gaps to adjust for skewness. Measures of skewness (Kolmogorov-Smirnov Ds) are given in Table 3. Next, the log-transformed anchor-estimate gaps were standardized within question across the six conditions to allow repeated-measures analyses.

138 out of 2352 observations were identical to the most popular and accessible answers through Wikipedia, Google, Ask.com and Yahoo searches (e.g., the length of Mississippi River is 2320 miles, answers identical to this value were excluded from final analyses); these observations were excluded in the final analysis, because these MTurk participants may have attempted to look up the answers on-line. Five outliers were excluded. Therefore, approximately 6% of the observations were deleted in the final analysis either for extremely implausible answers or possible attempts to look up answers on line.

A repeated measures fixed-effects regression² was conducted for the 3 (mood states) by 2 (cognitive load) repeated-measures factorial design, with anchor-estimate gaps as the dependent variable, and mood condition and cognitive-load condition as independent variables. The analysis indicated that, consistent with previous findings (Bodenhausen et al., 2000), individuals induced to sad moods demonstrated greater susceptibility to provided anchors than their counterparts ($M_{sad} = -.024$, $M_{happy} = .018$, $M_{neutral} = .002$, $t(93) = -2.81$, $p = .006$), although there was no significant difference in anchor-estimate gap in participants induced to happy and neutral moods. In other words, they provided absolute estimates closer to the anchor values. Also consistent with findings of Epley and Gilovich (2001, 2006), participants under cognitive load (with limited ability and opportunity to elaborate) showed larger anchoring effects ($M_{cogload} = .020$, $M_{noload} = .060$, $t(109) = -2.20$, $p = .03$). There was a significant interaction between mood states and the cognitive-load manipulation ($t(109) = -3.68$, $p = .0004$). Specifically, participants induced to sad mood showed smaller anchoring effect under cognitive load than their counterparts in the control condition, but greater anchoring effects when the cognitive load was absent. See Figure 1 for the means of anchor-estimate gap. Additionally, inconsistent with our hypothesis, participants in different mood states did not differ in their reported level of confidence ($t(719) = 0.55$, $p = .58$).

Supplementary Analysis

Further examination of the mood manipulation check suggests that participants across different mood conditions did not differ significantly in reported happiness or sadness by the end of the experiment ($p > .05$). Because the mood manipulation may have worked for only a

² The repeated measures fixed-effects regression was completed by Dan Schley.

short duration, we may get a clearer picture of the pattern by examining the first anchoring task in isolation (i.e., the length of Mississippi River). See Figure 2 for the means of anchor-estimate gap.

When the cognitive load was absent, the results were consistent with previous analyses: individuals induced to sad moods demonstrated greater anchoring effects than those in happy and neutral moods ($M_{sad} = -.07$, vs. $M_{happy} = .03$, $M_{neutral} = .09$, $F = 8.13$, $p = .0003$). There was no significant difference of magnitude of anchoring effects between individuals in happy and neutral moods. This finding for the first estimate only is consistent with the overall results of the study. Interestingly, when cognitive load was present, however, the pattern appeared different from the study's overall results. Individuals induced to sad moods showed smaller anchoring effects under cognitive load than those in the control condition, and there was a significant interaction between mood states and cognitive-load manipulation ($F = 15.39$, $p < .0001$). When the cognitive load was absent, the results were consistent with previous analysis, that individuals induced to sad moods demonstrated greater anchoring effects. This was inconsistent with the selective-accessibility model in that decreased deliberation results in greater anchoring effects.

The supplementary analysis also revealed that participants under cognitive load indicated significantly more confidence in their estimates than those in the control condition ($M_{cogload} = 4.54$, $M_{control} = 4.03$, $F = 11.09$, $p < .001$). Please see Figure 3 for the means. Inconsistent with previous hypotheses, however, participants' reported confidence in their judgment accuracy did not differ across mood conditions.

General Discussion

Anchoring-and-adjustment theory assumes that people anchor their judgments on the provided value and effortfully (but insufficiently) adjust away from the anchor (Kahneman & Tversky, 1974). Therefore, decreased deliberation (i.e., through cognitive load) should increase people's susceptibility to anchors. Our findings provide mixed support for this hypothesis. Overall, participants under cognitive load showed larger anchoring effects ($t(109) = -2.20, p = .03$). In other words, when they did not have the opportunity to deliberate about their judgments, their estimates were closer to the provided anchors. This finding supports predictions from anchoring-and-adjustment theory. However, there was a significant interaction between cognitive-load conditions and mood states ($F = 15.39, p < .001$). Specifically, within the sad condition, participants demonstrated greater anchoring effects than those in neutral- and happy moods when cognitive load was absent. The presence of cognitive load weakened the effects of anchors across all mood conditions; the result was in support of the anchoring-and-adjustment theory.

The selective accessibility model, on the other hand, was also partially supported by our results. The model postulates that anchoring effects result from a selective increase in mental accessibility of anchor-consistent information (Mussweiler & Strack, 1999; Chapman & Johnson, 1999). The more extensively individuals deliberate on the initial anchor value, the more anchor-consistent information they are likely to generate and the stronger the effects of provided anchors. According to this model, the cognitive-load manipulation therefore should decrease the magnitude of anchoring effects. Overall, our findings are at odds with this prediction. However, selective accessibility model does seem to fit with the pattern we

observed within the sadness condition. That is, imposing cognitive load decreases anchoring effects in individuals induced to sad moods. However, this same cognitive-load manipulation did not have the same effects in the other mood conditions as would be predicted by the model. Our overall finding that participants under cognitive load showed larger anchoring effects is consistent with results from most previous studies (e.g., Epley & Gilovich, 2001, 2006; Schley & Turner, in review). Further studies are needed to determine the mechanisms underlying anchoring effects.

It was hypothesized that a lack of confidence in initial estimates, rather than a greater degree of cognitive processing, would account for sad participants' greater susceptibility to the effect of anchors compared to happy- or neutral-mood participants. The hypothesis was not supported by the data.

Neither anchoring-and-adjustment nor the selective-accessibility model was fully supported by our findings. Bodenhausen et al. (2000) proposed that an increased level of deliberation was responsible for the greater susceptibility to anchoring bias in individuals induced to sad moods, compared to those in neutral- and happy-moods. However, our data suggest that, on average, greater levels of deliberation (in the no-load vs. load conditions) decreased anchoring effects. Therefore, it is not likely that increased deliberation causes larger anchoring biases in individuals induced to sad moods. Although research has demonstrated that sadness is indeed associated with more deliberative and effortful processing (Bodenhausen, Kramer, & Süsser, 1994), there is also evidence that sadness can influence information processing in multiple ways (Peters, 2006). Here, we propose that, instead of resulting in increased levels of deliberation, sadness directs people's attention to

different types of information and individuals induced to sad moods engage in different information search processes compared to those induced to neutral and happy moods.

Peters (2006) argues that affect has four separable roles in judgment and decision processes. First, it can act as information. People may consult their feelings about a target or option at the time of decisions and ask “how do I feel about this?” (Schwarz & Clore, 2003) and rely on their momentary feelings to form impressions and make subsequent judgments. Second, affect can act as a spotlight and guide people’s attention to different information, making some information more salient than other. Third, affect can motivate people to take action or exert extra effort. Lastly, affect can act as a common currency to facilitate value judgments. In the following sections, we will discuss how affect can act as a spotlight, and how such a mechanism may help explain the results of the current study.

Recent research has suggested that anchors themselves can provide information by selectively accessing prior knowledge about target items (as the selective accessibility model postulates), but they can also act as a direct source of information. The anchor can provide new information about the target item (Schley & Peters, 2012; Wegener, Petty, Blankenship, & Detweiler-Bedell, 2010). The Integrative Theory of Anchoring (ITA) (Schley & Turner, 2012) suggests that anchoring effects emerge from a process of information integration. That is, when presented with an anchor, individuals integrate the “new” information provided by the anchor with their *a priori* representation of the target to produce a judgment.

According to ITA, during the integration process, individuals attend to two values: 1) their prior representation of the target, and 2) the provided anchor information. The results of our current study are consistent with the notion that individuals’ incidental mood states might

have directed their attention to either anchor-consistent information, or to anchor-inconsistent information and changed the ITA's information integration process. Compared to happy or neutral participants, individuals induced to sad moods may be particularly motivated to seek out anchor-consistent information, because the anchor information is new and due to a desire to alter their current situations.

Different affective states also may activate different implicit goals (Raghunathan & Pham, 1999). Emotions are associated with certain sets of behavioral tendencies (Peters, 2006). Sadness has been shown to create an urgent, implicit desire to change one's current circumstances (e.g., Lerner et al., 2004), perhaps by seeking immediate rewards (Lerner et al., 2012). According to appraisal theorists, the distinctive cognitive components, or meaning structure, underlying sadness is the loss or absence of a reward (Lazarus, 1991). Consequently, individuals are prone to interpret their feelings as meaning that "something is missing" and are motivated by an implicit goal of reward acquisition or substitution.

Since negative feelings are generally interpreted as disliking or dissatisfaction, whereas positive feelings are often interpreted as liking or satisfaction (Pham, 1998; Schwarz & Clore, 1983), it is possible that individuals induced to sad moods were dissatisfied with their prior estimates, which were considered to be parts of "my situation", and therefore rely more on the anchors. In contrast, individuals induced to positive moods may have been satisfied with their prior representation of the target and less willing to adopt the "new" anchors.

Peters et al. (2003) proposed that affect can act as a spotlight in a two-stage process. The quality of affective feelings directs individuals to different information, and that

information is then used to guide judgments and decisions. In this case, sadness might direct individuals' attention to the anchor value because individuals in sad moods tend to be more dissatisfied with their prior estimates and eager to update their initial judgment with the new information provided by the anchors, whereas neutral and positive moods may focus individuals' attention on their prior estimate due to less reliance on the new anchor information.

As mentioned above, the distinctive pattern we observed may be due to differential information processing strategies unique to sadness versus happiness or neutral mood. It is possible that, whereas people in neutral or positive moods may seek anchor-inconsistent information when they are provided with an anchor value, individuals induced to sad moods may be motivated by a feeling of dissatisfaction or disliking of their a priori estimates.

Individuals induced to happy or neutral moods, on the other hand, may be more satisfied with their prior representation of the target items and more skeptical of the anchor information. Therefore, they may engage in a process similar to the one proposed by anchoring-and-adjustment theory. That is, they anchor their judgments on the provided anchor value, and then effortfully adjust their estimate away from the anchor (Kahneman & Tversky, 1974). If the attention-demanding nature of the adjustment process was hindered by cognitive load, individuals would show larger anchoring effects, as the current study has demonstrated.

Implications for Future Studies

As mentioned above, neither anchoring-and-adjustment nor the selective accessibility model are fully supported by our data. Anchoring-and-adjustment theory explains why,

overall, the presence of cognitive load resulted in large anchoring effects in happy and neutral mood conditions, but it fails to account for the decrease in anchoring effects among individuals induced to sad moods under cognitive load. The selective accessibility model predicts that cognitive load will decrease anchoring effects, but this prediction only holds true for participants in the sad mood states. Further studies on the influence of cognitive load on anchoring effects may help to shed light on the underlying mechanisms of this process.

In the general discussion we proposed a possible mechanism to account for the results of the current study. This account is based on the assumption that anchoring is essentially a process of information acquisition and integration (Schley & Turner, 2012). Affective feelings may then act as spotlight and a motivator to direct individuals' attention to different information, with this new information then serving as a basis for their judgments. To test the validity of this speculation, future researchers may consider using memory recall tasks (e.g., test whether individuals remember previously presented information) to trace the kinds of information to which individuals direct their attention. For example, it is feasible to provide participants with background knowledge (e.g., Wegener et al., 2010) which contains both anchor-consistent and anchor-inconsistent information, and follow up with recognition tasks.

Limitations. The current study only investigated three affective states, namely, sad, neutral mood, and happy moods. Since affective feelings differ widely in terms of their intensity, cognitive appraisals and implicit goals, far more studies are needed to examine various effects of affect on anchoring effects.

Also, as noted in the results section, the length of the mood manipulation task may not have been ideally proportional to the length of the judgment task (i.e., the eight anchoring

questions). The effects of mood might have worn off before participants finished the eight anchoring questions. Future studies should either decrease the number of anchoring questions or increase the length or intensity of the mood manipulation.

Conclusion

The current studies investigated the underlying mechanisms of the influence of mood states on anchoring effects. As the results indicated, individuals under cognitive load showed, on average, larger anchoring effects compared to those in the no-cognitive-load condition. Consistent with previous findings, we also found that individuals induced to sad moods demonstrated greater susceptibility to provided anchors than their counterparts. However, existing theories provide little explanation for the observed interaction between mood states and cognitive-load manipulation; specifically, why did individuals induced to sad moods react to the cognitive-load manipulation in the opposite pattern compared to those in neutral or happy mood conditions? Drawing from research concerning affective influences in decision making, we proposed a tentative explanation for the results, specifically that sadness directs people's attention to different types of information and the salience of information subsequently determines the degree to which people are influenced by the anchor values. Further research is needed to unveil the processes of anchoring effects and account for the influence of affect on this phenomenon.

References

- Bodenhausen, G. V., Gabriel, S., & Lineberger, M. (2000). Sadness and susceptibility to judgmental bias: the case of anchoring. *Psychological Science, 11*, 320-323.
- Bodenhausen, G. V., Sheppard, L. A., & Kramer, G. P. (1994). Negative affect and social judgment: The differential impact of anger and sadness. *European Journal of Social Psychology, 24*, 45-62.
- Carpenter, S. M., Peters, E., Västfjäll, D., & Isen, A. M. (2013). Positive feelings facilitate working memory and complex decision making among older adults. *Cognition & Emotion, 27* (1), 184-192.
- Cervone, D., & Peake, P. K. (1986). Anchoring, efficacy, and action: the influence of judgmental heuristics on self-efficacy judgments and behavior. *Journal of Personality and Social Psychology, 50*, 529-501.
- Chapman, G. B., & Johnson, E. J. (1999). Anchoring, activation and the construction of value. *Organizational Behavior and Human Decision Processes, 79*, 115-153.
- Damasio, A.R. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: Putnam.
- Edwards, J. A., & Weary, G. (1993). Depression and the impression-formation continuum: Piecemeal processing despite the availability of category information. *Journal of Personality and Social Psychology, 64*(4), 636-645.

Englich, B., & Mussweiler, T. (2001). Sentencing under uncertainty: Anchoring effects in the courtroom. *Journal of Applied Social Psychology*, 31, 1535-1551.

Epley, N., & Gilovich, T. (2006). The anchoring and adjustment heuristic: Why adjustments are insufficient. *Psychological Science*, 17, 311-318.

Estrada, C. A., Isen, A. M., & Young, M. J. (1997). Positive Affect Facilitates Integration of Information and Decreases Anchoring in Reasoning among Physicians. *Organizational Behavior and Human Decision Processes*, 72(1), 117-135.

Forgas, J.P. (1995). Mood and judgment: The affect infusion model (AIM). *Psychological Bulletin*, 117, 39-66.

Gilbert, D. T. (2002). Inferential correction. In D. G. T. Gilovich & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (p. 167-184). Cambridge, England: Cambridge University Press.

Han, S., Lerner, J. S., & Keltner, D. (2007). Feelings and consumer decision making: The appraisal-tendency framework. *Journal of Consumer Psychology*, 17(3), 158-168.

Inbar, Y., & Gilovich, T. (2011). Angry (or Disgusted), but Adjusting? The Effect of Specific Emotions on Adjustment From Self-Generated Anchors. *Social Psychological and Personality Science*, 2, 563-569.

Jacowitz, K. E., & Kahneman, D. (1995). Measures of anchoring in estimation tasks. *Personality and Social Psychology Bulletin*, 21, 1161-1167.

Johnson, E. J., & Schkade, D. A. (1989). Bias in utility assessments: Further evidence and explanations. *Management Science*, 35, 406-424.

Keltner, D., Ellsworth, P. C., & Edwards, K. (1993). Beyond simple pessimism: Effects of sadness and anger on social perception. *Journal of Personality and Social Psychology*, 64, 740-752.

Kehner, D., Locke, K. D., & Aurain, P. C. (1993). The influence of attributions on the relevance of negative feelings to personal satisfaction. *Personality and Social Psychology Bulletin*, 19(1), 21-29.

Kraiger, K., Billings, R. S., & Isen, A. M. (1989). The influence of positive affective states on task perceptions and satisfaction. *Organizational Behavior and Human Decision Processes*, 44, 12-25.

Isen, A. M. (2008). Some ways in which positive affect influences decision making and problem solving. *Handbook of emotions*, 548-573.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist*, 46(8), 819-834.

Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology*, 81, 146-159.

Lerner, J. S., & Tiedens, L. Z. (2006). Portrait of the angry decision maker. *Journal of Behavioral Decision Making*, 19, 115-137.

Loewenstein, G., & Lerner, J.S. (2002). The role of affect in decision making. In R. Davidson, K. Scherer, & H. Goldsmith (Eds.), *Handbook of affective science* (pp. 619–642). New York: Oxford University Press.

Mackie, D. M., & Worth, L. T. (1989). Processing deficits and the mediation of positive affect in persuasion. *Journal of Personality and Social Psychology*, 57(1), 27-40.

Mussweiler, T., & Strack, F. (1999). Hypothesis-consistent testing and semantic priming in the anchoring paradigm: A selective accessibility model. *Journal of Experimental Social Psychology*, 35, 136-164.

Northcraft, G. B., & Neale, M. A. (1987). Experts, amateurs, and real estate: An anchoring-and-adjustment perspective on property pricing decisions. *Organizational Behavior and Human Decision Processes*, 39, 44-64.

Peters, E. (2006). The functions of affect in the construction of preferences. *The construction of preference*, 454-463.

Peters, E., Slovic, P., & Gregory, R. (2003). The role of affect in the WTA/WTP disparity. *Journal of Behavioral Decision Making*, 16(4), 309-330.

Peters, E., Slovic, P., Hibbard, J. H., & Tusler, M. (2006). Why worry? Worry, risk perceptions, and willingness to act to reduce medical errors. *Health Psychology*, 25(2), 144-152.

Plous, S. (1989). Thinking the unthinkable: the effect of anchoring on likelihood estimates of nuclear war. *Journal of Applied Social Psychology*, 19, 67-91.

- Raghunathan, R., & Pham, M. T. (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational behavior and human decision processes*, 79, 56-77.
- Russell, J. A., & Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. *Journal of personality and social psychology*, 76(5), 805.
- Schley, D. R., & Peters, E. (2012). *Precise numbers are more believable*. (Manuscript submitted for publication)
- Schley, D. R., & Turner, B. M. An Integrative Theory of Judgmental Anchoring. (In review)
- Schwarz, N., Bless, H., & Bohner, G. (1991). Mood and persuasion: Affective states influence the processing of persuasive communications. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 24, pp. 161–197). San Diego, CA: Academic Press.
- Small, D. A., & Lerner, J. S. (2008). Emotional politics: Personal sadness and anger shape public welfare preferences. *Political Psychology*, 29, 149–168.
- Sinclair, R.C., & Marks, M.M. (1992). The influence of mood state on judgment and action: Effects on persuasion, categorization, social justice, person perception, and judgmental accuracy. In L.L. Martin & A. Tesser (Eds.), *The construction of social judgment* (pp. 165–193). Hillsdale, NJ: Erlbaum.
- Smith, C. A., & Ellsworth, P. C. (1985). Patterns of cognitive appraisal in emotion. *Journal of Personality and Social Psychology*, 48, 813–838.

Tiedens, L. Z., & Linton, S. (2001). Judgment under emotional certainty and uncertainty: The effects of specific emotions on information processing. *Journal of Personality and Social Psychology*, 81, 973–988.

Wegener, D. T., Petty, R. E., Blankenship, K. L., & Detweiler-Bedell, B. (2010). Elaboration and numerical anchoring: Breadth, depth, and the role of (non-)thoughtful processes in anchoring theories. *Journal of Consumer Psychology*, 20, 5-16.

Table 1.

Certainty Appraisal

Mood	Certainty
happiness	-0.46
sadness	0
anger	-0.29
fear	0.73

* Certainty: high scores indicate increased uncertainty

Table 2.

Deliberation, Certainty and Magnitude of Anchoring Effects

Mood	Deliberation	Certainty	Magnitude of Anchoring Effects
happiness	high	high	small
sadness	high	low	high

Table 3.

Kolmogorov-Smirnov D before and after log transformation

	Before Log Transformation	After Log Transformation
Anchor-Estimate Gap Question 1	0.191877	0.222657
Anchor-Estimate Gap Question 2	0.45774	0.170444
Anchor-Estimate Gap Question 3	0.454134	0.274817
Anchor-Estimate Gap Question 4	0.448482	0.216272
Anchor-Estimate Gap Question 5	0.197939	0.204188
Anchor-Estimate Gap Question 6	0.286522	0.120162
Anchor-Estimate Gap Question 7	0.140343	0.193524
Anchor-Estimate Gap Question 8	0.455341	0.248453

* Smaller Kolmogorov-Smirnov D values indicate less non-normality in the distributions.

Figure 1.

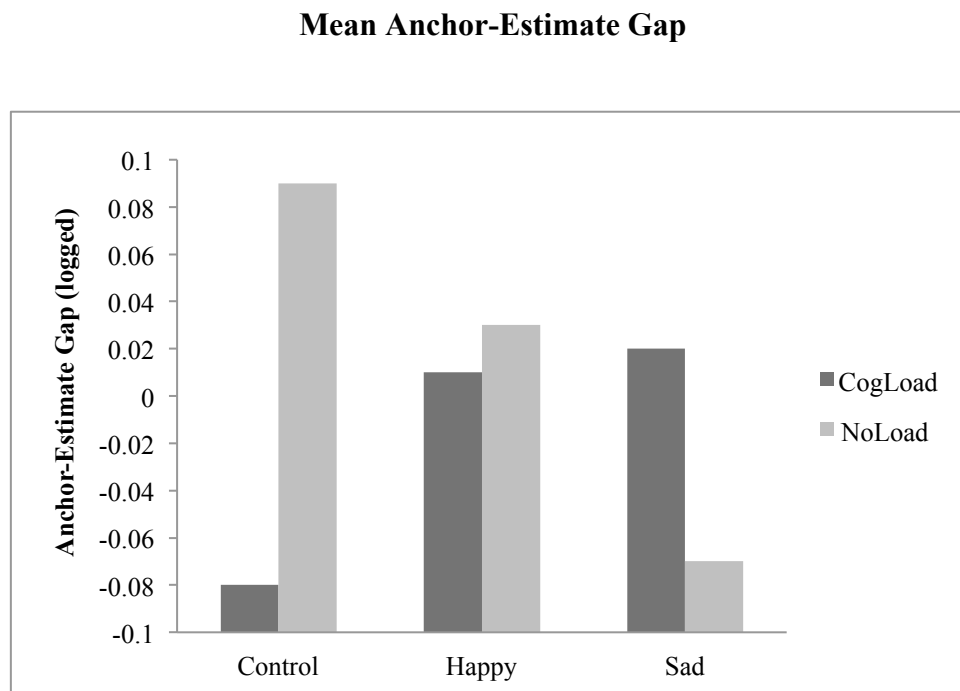


Figure 1. Mean anchor-estimate gap. Participants under cognitive-load showed larger anchoring effects ($t(109) = -2.20, p = .03$). Individuals induced to sad moods demonstrated greater susceptibility to provided anchors than their counterparts ($t(93) = -2.81, p = .006$).

Figure 2.

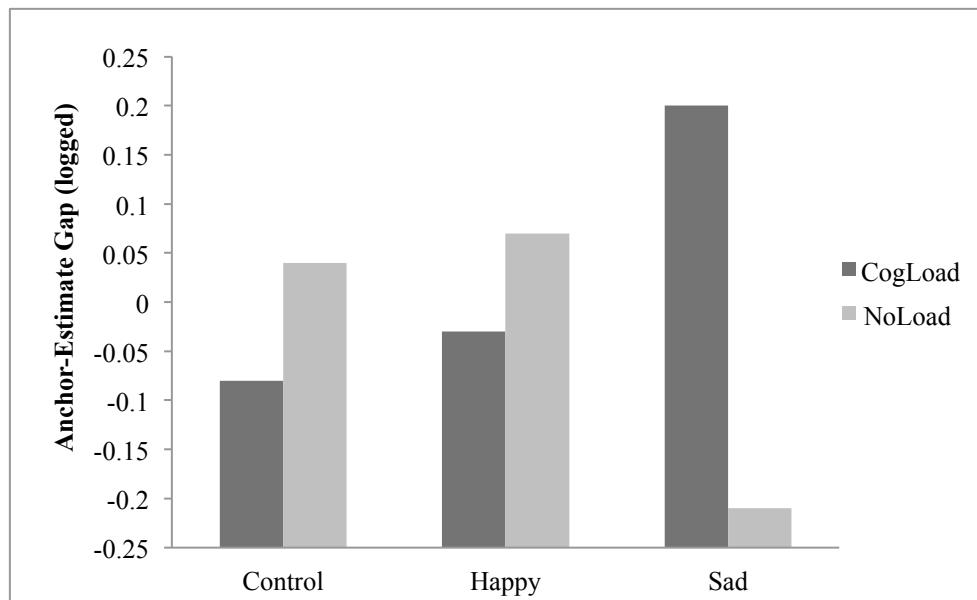
Mean Anchor-Estimate Gap for the First Estimate (i.e., the length of Mississippi River)

Figure 2. When the cognitive load was absent, the results were consistent with previous analysis, that individuals induced to sad moods demonstrated greater anchoring effects ($M_{sad} = -.07$, vs. $M_{happy} = .03$, $M_{neutral} = .09$, $F = 8.13$, $p = .0003$). Interestingly, when cognitive load was present, the pattern appeared different. Individuals induced to sad moods showed smaller anchoring effects under cognitive load, and there is a significant interaction between mood states and cognitive -load manipulation ($F = 15.39$, $p < .0001$).

Figure 3.

Mean Confidence for the First Estimate (i.e., the length of Mississippi River)

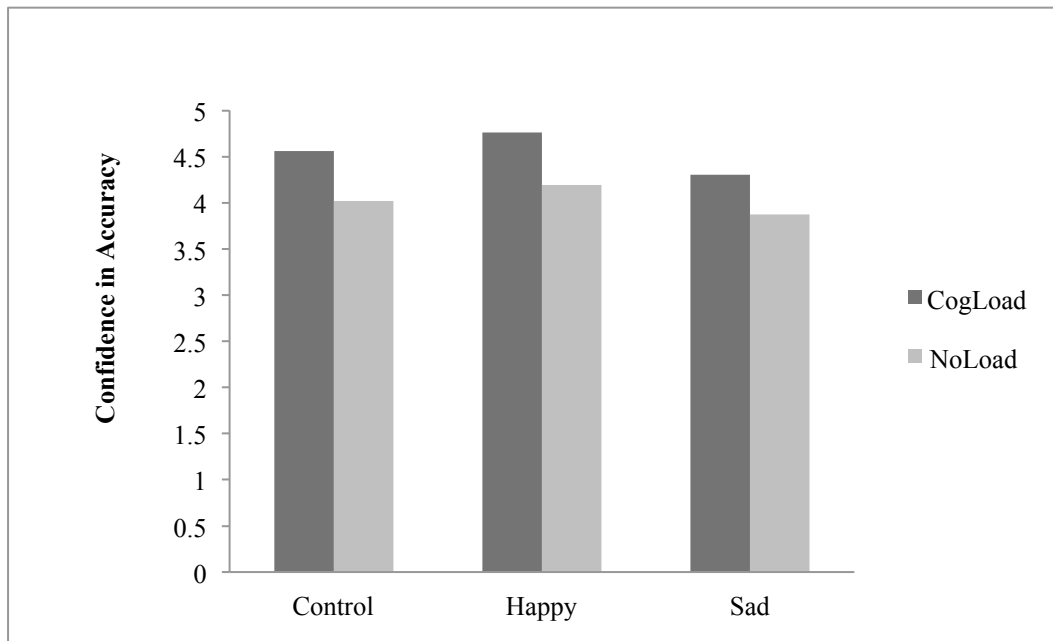


Figure 3. Participants under cognitive load indicated significantly more confidence in their estimates than those in the control condition ($M_{\text{cogload}}=4.54$, $M_{\text{control}}=4.03$, $F=11.09$, $p<.001$)

Appendix A

Mood Scale

The following scale consists of a number of words that describe different feelings and emotions. Indicate how much you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

1. Please indicate how **happy** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

2. Please indicate how **sad** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

3. Please indicate how **angry** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

4. Please indicate how **sluggish** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

5. Please indicate how **quiet** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

6. Please indicate how **enthusiastic** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

7. Please indicate how **surprised** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

8. Please indicate how **calm** you feel right now?

0 (not at all) 1 2 3 4 5 6 7 8 (extremely)

Appendix B

Sample Cognitive-Load Question

Please memorize the following string of letters.

You will be asked to recall these letters at a later time.

Please do not write the letters down, we are interested in what you can memorize.

C M S W E O L P T

After the judgment task:

Please enter the string of letters, that you memorized a couple of pages back, in the space provided below.
